CHAPTER 5

ACCIDENT CAUSATIVE FACTORS

5.1 BACKROUND

Highway accidents are primarily influenced by road, vehicle, road user and environment. The accidents occurring on highways are mostly contributed by traffic condition and road environment. Highways are not able to meet out the current status of traffic flow. Generally highways carry heavy vehicles like buses, Lorries, trucks, and containers apart from light commercial vehicles and two-wheelers. Each category of vehicle has different static and dynamic characteristics and operates at various speeds.

5.2 TRAFFIC VOLUME (FLOW)

Indian traffic condition is mixed type consisting of various categories of vehicles like heavy vehicles, light commercial vehicles, two wheelers, autos, bullock carts etc. Each vehicle has different static and dynamic characteristics. Every year traffic volume through highways is getting increased due to infrastructure development and increasing population. At the same time the number of accidents also increases with traffic volume and positive correlation exists between traffic volume and accidents, (Do-Gyeong Kim, 2006). In general as VKT increases accidents increase and also vary with hourly, daily, monthly and seasonal variation of traffic flow.

5.3 HEAVY VEHICLES

Heavy vehicles include transport corporation buses, private buses, lorries, tractors and container trucks. Due to population increase and industrialization, major share of traffic flow through NH and SH is by heavy vehicles carrying passengers, sand, cement and other goods.

About 61% of accidents occur due to heavy vehicles in the country (Landge, 2006). Based on general accident report heavy vehicles versus light commercial vehicles accidents are the maximum. More number of accidents are caused due to the fact that fast moving vehicles overtake the slow moving vehicles, where inadequate overtaking sight distance is available. Parked heavy vehicles also contribute to road accidents.

5.4 SPEED

Speed studies have always pointed to the fact that drivers adapt their speeds according to the highway ahead and may exceed both the speed limit and design speed. The operating speed is usually taken as 85^{th} percentile speed, defined as the speed that 85% of the drivers do not exceed. Different highway elements are designed based on an arbitrary value of the design speed assumed by the designer. By setting a speed limit lower than the design speed, traffic safety is achieved assuming that drivers will not exceed the speed limit (Hassan, 2000).

The drivers tend to slow down on underdesigned curves with design speeds less than 96.5 kmph because of signing and visual perception and thus avoid severe accidents such as fixed object collision like parked vehicles. The drivers must continuously acquire information (detect hazard), make estimates of further development of traffic situations, and make decisions concerning their own acts in practice. All these phases take time.

With increasing speed, the time available for the driver decrease. And when time for observation and decision making decreases, the chance for errors that can potentially lead to accidents increases. Furthermore, with increasing speed the time and distance available for evasive actions (e.g. braking or steering) decrease. Therefore drivers of slower vehicles can start braking further away from the hazard ahead than drivers of fast vehicles. The distance that faster vehicles have available for braking or steering maneuvers is short.

Higher speeds also increase the accident risk of other road users. Specifically road users tend to overestimate the distance and underestimate the speed of the approaching vehicle and these estimation errors and their variance increase with speed. Appropriate speed limits are necessary components to ensure a reasonable level of safe and efficient travel on highways and streets. The practice of speed control was found on the assumption that controlling speeds reduces accidents. (Kenneth,1997).

The current American Association of State Highway and Transportation Officials (AASHTO) definition for design speed is the maximum safe speed that can be maintained over a specified section of highway when conditions are so favourable that the design features of the highway govern. The AASHTO definition for operating speed is the highest overall speed at which a driver can travel on a given highway under favourable weather conditions under prevailing traffic conditions without any time delay. In general practice, the posted speed limit sets the maximum speed limit for a roadway such that the operating speed may be above the design speed for a particular location of the roadway. When this situation occurs, warning sign with advisory speeds may be used to warn drivers to reduce their speed to less than the posted speed limits.

The 85th percentile speed is commonly used by highway agencies for describing actual operations speeds and establishing speed limits. This is the speed at or below which 85 percent of the traffic is traveling and is thought by many traffic engineers to reflect the safe speed for given road conditions. The 85th percentile speed is the speed range in which the accident involvement rate is lowest.

5.5 SEGMENT LENGTH

Segment length is the length of highway under the jurisdiction of respective police station. Segment length has number of straight stretches and horizontal curves. Straight segment has maximum visibility while curved sections are with (limited) restricted visibility. Segment length is exposed to variety of land use like residential, commercial, institutional and industrial activities. Presence of such zones is the main cause for accidents. For curves, crash frequency was found to increase with section length and for tangents the number of accidents per year increases with segment length (Cirol Caliendo 2007). Generally, speed of vehicles in straight stretch is greater than the speed in other sections.

5.6 ACCESS ROADS

Access roads are like driveways and intersecting roads, which connect residential zones, commercial zones, agricultural zone and institutional zones with main highway. Driveways are positively correlated with road accidents (Do-Gyeong Kim, 2006). Access roads at unauthorized places are dangerous. As the land use activity along highway develops access roads at inappropriate places become very common and such roads connecting industries, institutions and financial institutions are the key factor for accidents during morning and evening peak times. In general, accident

rate at horizontal curves is greater than accident rate at straight stretch with access roads, due to lack of visibility.

5.7 CURVES

Generally highway curves are sharp and railway curves are larger. Many road crashes occur on bends in road and sharp bends are more likely to have crashes than gentle bends (Robin Hynes et al, 2008). Horizontal curves on highways are on average more hazardous than tangent sections. As their curvatures increase, horizontal curves tend to have higher accident rates (Feng Bor Lin, 1990). Areas with mostly curved roads had lower crash rates than areas with straight roads. The elements of simple curve involve curve length, radius, degree of curvature and tangent distance. As the number of road curvature over large area increases, it might be proactive. Reduction in speed increases driver vigilance and discouragement of risk-taking behaviour might be the possible mechanism for the effect on horizontal curve as the driver gets limited visibility. In general, the road alignment is decided with certain number of horizontal right turn and left turn curves, to avoid the driver being monotonous.

5.8 SUMMARY

Observation over the different accident scenes establishes that the majority of the variables causing highway accidents are traffic flow, speed, VKT, access roads and horizontal curves. Generally highway traffic includes heavy vehicles, light commercial vehicles and two-wheelers. Even though low percentage of vehicular composition is contributed by heavy vehicles, the effect of heavy vehicles on accidents is studied in this work.